Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended): A method of determining an optimum bit load per subchannel in a multicarrier system with forward error correction, comprising:

computing one or more values of a number of bit positions b of a quadrature-amplitude-modulation symbol, ~~a maximum number of symbol errors that can be corrected t, and~~ based on one or more values of a number of symbols in the information field K, and one or more values of a number of control code symbols per discrete-mult-tone symbol z, to provide one or more determined values of b, ~~to determine the optimum bit load per subchannel~~ in accordance with the following relationship:

$$1-\left(1-W(s,z,K)\varepsilon_S^{\frac{1}{0.5\cdot sz+1}}\right)^{1/\alpha} = \omega\left(b\left(\gamma_{eff},s,z\right)\right)\left(1-2^{-b\left(\gamma_{eff},s,z\right)/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}/\left(2^{b\left(\gamma_{eff},s,z\right)+1}-2\right)}\right), \cancel{\text{and}}$$
$$\times\left[2-\left(1-2^{-b\left(\gamma_{eff},s,z\right)/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}/\left(2^{b\left(\gamma_{eff},s,z\right)+1}-2\right)}\right)\right]$$

$$\cancel{W(s,z,K)=\left[\frac{\Gamma(K+s+sz)}{\Gamma(K+s+0.5\cdot sz)\Gamma(0.5\cdot sz+1)}\right]^{-1/(0.5\cdot sz+1)}}$$

$$W(s,z,K)=\left[\frac{\Gamma(K+\rho s+sz)}{\Gamma(K+\rho s+0.5\cdot sz)\Gamma(0.5\cdot sz+1)}\right]^{-1/(0.5\cdot sz+1)}$$

$$\cancel{\text{wherein}}\ \omega(b)=\frac{4}{2b+3},$$

$$\Gamma(x)=(x-1)!, \text{ and}$$

$$b\left(\gamma_{eff}, s, z\right)=\frac{\alpha}{s n_{eff}}(K+\rho s+zs)$$

s represents a number of discrete-multi-tone symbols in a frame, ε_s represents a symbol error rate, α represents the size of a code symbol, ρ represents a framing mode index, ~~z represents a number of control code symbols per discrete-multi-tone symbol, b represents a number of bit positions of a quadrature-amplitude-modulation symbol,~~ $\omega(b)$ represents an average fraction of erroneous bits in an erroneous b-sized quadrature-amplitude-modulation symbol, γ_{eff} represents an effective signal-to-noise ratio, and n_{eff} represents an effective number of subchannels; and

selecting the value of K and the value of z which provides a maximum number of bit positions based on the one or more determined values of b ~~the maximum number of symbol errors that can be corrected t, and the number of symbols in the information field K such that the uncoded bit error rate p_b that produces a symbol error rate that is less than or equal to the target symbol error rate is increased~~.

Claim 2 (original): The method of claim 1 wherein the effective signal-to-noise ratio γ_{eff} is an average signal-to-noise ratio of at least a subset of the channels.

Claim 3 (currently amended): The method of claim 1 wherein the size of the frame ranges from 0 to N_{max}-s-zs symbols, where N_{max} is a predetermined value.

Claim 4 (currently amended): The method of claim 1 further comprising:

determining a difference $\Theta(K)$ between a bit error rate prior to decoding and ~~the~~ a target bit error rate (p_e) based on one or more values of a length of an information field K

within a range from 0 to N_{max}-ρs-sz, where N_{max} is a predetermined value, in accordance with the following relationship:

$$\Theta(K) = \omega(b(\gamma_{eff}, s, z))p_{QAM} - p_e \text{, and}$$

$$\begin{aligned}\omega(b(\gamma_{eff}, s, z))p_{QAM} &= \omega\left(\frac{\alpha}{sn_{eff}}(K + s + zs)\right)\left(1 - 2^{-\frac{\alpha}{2sn_{eff}}(K+s+zs)}\right) erfc\left(\sqrt{3 \cdot 10^{\gamma_{eff}/10} \Big/ \left(2^{\frac{\alpha}{sn_{eff}}(K+s+zs)+1} - 2\right)}\right) \\ &\times \left[2 - \left(1 - 2^{-\frac{\alpha}{2sn_{eff}}(K+s+zs)}\right) erfc\left(\sqrt{3 \cdot 10^{\gamma_{eff}/10} \Big/ \left(2^{\frac{\alpha}{sn_{eff}}(K+s+zs)+1} - 2\right)}\right)\right]\end{aligned}$$

$$\begin{aligned}\omega(b(\gamma_{eff}, s, z))p_{QAM} &= \omega\left(\frac{\alpha}{sn_{eff}}(K + \rho s + zs)\right)\left(1 - 2^{-\frac{\alpha}{2sn_{eff}}(K+\rho s+zs)}\right) erfc\left(\sqrt{3 \cdot 10^{\gamma_{eff}/10} \Big/ \left(2^{\frac{\alpha}{sn_{eff}}(K+\rho s+zs)+1} - 2\right)}\right) \\ &\times \left[2 - \left(1 - 2^{-\frac{\alpha}{2sn_{eff}}(K+\rho s+zs)}\right) erfc\left(\sqrt{3 \cdot 10^{\gamma_{eff}/10} \Big/ \left(2^{\frac{\alpha}{sn_{eff}}(K+\rho s+zs)+1} - 2\right)}\right)\right]\end{aligned}$$

$$p_e = \left[1 - \left(1 - W(s, z, K)\varepsilon_S^{\frac{1}{0.5 \cdot sz+1}}\right)^{1/\alpha}\right]$$

wherein p_{QAM} represents a probability of error in transmitting a quadrature-amplitude-modulation waveform representing a 2^b point constellation~~, and p_e represents a channel symbol error rate~~; and

comparing the value of $\Theta(0)$ and $\Theta(N_{max}\text{-}s\text{-}zs)$ to 0; and

setting the value of K ~~to a predetermined value~~ in response to the comparing.

Claim 5 (currently amended): The method of claim 4 further comprising:~~wherein~~
when $\Theta(0)<0$ and $\Theta(N_{max}\text{-}s\text{-}sz)<0$, setting $K=N_{max}\text{-}s\text{-}zs$.

Claim 6 (currently amended): The method of claim 4~~1~~ further comprising:
setting $b(\gamma_{eff}, s, z)$equal to $(\alpha\ N_{max})/(s\ n_{eff})$ for all values of γ_{eff} and z.

$$\cancel{\frac{\alpha\ N_{max}}{s\ n_{eff}}}.$$

Claim 7 (currently amended): The method of claim 4~~1~~ wherein when $\Theta(0)>0$ and $\Theta(N_{max}\text{-}s\text{-}sz)>0$, setting $K=N_{max}\text{-}1$.

Claim 8 (currently amended): The method of claim 7 further comprising:
setting~~$b(\gamma_{eff}, s, z)$ equal to $b(\gamma_{eff}, 1, 0)$~~ $s=1$ and $z=0$.

Claim 9 (currently amended): A method of selecting forward error correction parameters in a channel having a plurality of subchannels in a multicarrier communications system, comprising:

determining a signal-to-noise ratio representing a subset of the subchannels to provide~~said~~ a representative performance measurement;

storing, in a table, the number (s) of discrete multi-tone symbols in a forward-error-correction frame, the number (z) of forward-error-correction control symbols in the discrete multi-tone symbol associated with the signal-to-noise ratio, and the number of subchannels associated with the signal-to-noise ratio, and a net coding gain for different values of s, z, signal-to-noise ratios and numbers of subchannels; and

selecting forward error correction parameters of the channel based on the net coding gain by applying an approximation to a subset of values in the table.

Claim 10 (original): The method of claim 9 wherein the approximation is a bilinear approximation.

Claim 11 (currently amended): A method of selecting forward error correction parameters in a channel having a plurality of subchannels in a multicarrier communications system, comprising:

determining a signal-to-noise ratio representing a subset of the subchannels to provide ~~said~~ a representative performance measurement;

storing, in a table, the number (s) of discrete multi-tone symbols in a forward-error-correction frame, the number (z) of forward-error-correction control symbols in the discrete multi-tone symbol associated with the signal-to-noise ratio, the maximum number of transmissions (k) and the number of subchannels associated with the signal-to-noise ratio, and a net coding gain for different values of s, z, signal-to-noise ratios and numbers of subchannels; and

selecting forward error correction parameters of the channel based on the net coding gain by applying an approximation to a subset of values in the table.

Claim 12 (original): The method of claim 11 wherein the approximation is a bilinear approximation.

Claim 13 (original): The method of claim 11 wherein and the values of s and z are in accordance with the G.dmt standard.

Claim 14 (original): The method of claim 13 wherein the values of s and z are in accordance with the G.lite standard, such that a subset of the tables associated with the values of s and z in accordance with the G.dmt standard are used when the channel uses the G.lite standard.

Claim 15 (original): A method of increasing a bit load of a multicarrier system comprising a channel having a plurality of subchannels, comprising:

determining a bit load for at least one subchannel based on a target symbol error rate ε_s, a maximum number of symbol errors that can be corrected t, a number of symbols in an

information field *K*, and a maximum number of transmissions *k*, and a number of bits per subchannel; and

selecting the maximum number of symbol errors *t*, the number of symbols in the information field *K* and the maximum number of transmissions *k*, such that a net coding gain is increased, and wherein *t*, *K* and *k* are also selected such that no forward error correction is applied when the number of subchannels exceeds a predetermined threshold number of subchannels.

Claim 16 (original): The method of claim 15 wherein the channel uses the G.dmt standard.

Claim 17 (original): The method of claim 15 wherein the channel uses the G.lite standard.

Claim 18 (currently amended): A method of determining an optimum bit load per subchannel in a multicarrier system with forward error correction, comprising:

computing one or more values of a number of bit positions *b* of a quadrature-amplitude-modulation symbol based on one or more values of a number of symbols in an information field *K*, one or more values of a number of control code symbols per discrete-multi-tone symbol *z*, and a maximum number of transmissions *k*, to provide one or more determined values of *b*, ~~maximum number of symbol errors that can be corrected t, and a number of symbols in the information field K to determine the optimum bit load per subchannel~~ in accordance with the following relationship:

$$1-\left(1-W(s,z,K)\varepsilon_S^{\frac{1}{0.5\cdot sz+1}}\right)^{1/\alpha} = \omega\left(b\left(\gamma_{eff},s,z\right)\right)\left(1-2^{-b\left(\gamma_{eff},s,z\right)/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}/\left(2^{b\left(\gamma_{eff},s,z\right)+1}-2\right)}\right)\cancel{,\ \text{and}}$$
$$\times\left[2-\left(1-2^{-b\left(\gamma_{eff},s,z\right)/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}/\left(2^{b\left(\gamma_{eff},s,z\right)+1}-2\right)}\right)\right]$$

$$1-\left(1-W(s,z,K,k)\varepsilon_S^{\frac{1}{k(0.5sz+1)}}\right)^{1/\alpha}$$
$$=\omega(b(\gamma_{eff},s,z))\left(1-2^{-b(\gamma_{eff},s,z)/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}/\left(2^{b(\gamma_{eff},s,z)+1}-2\right)}\right)$$
$$\times\left[2-\left(1-2^{-b(\gamma_{eff},s,z)/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}/\left(2^{b(\gamma_{eff},s,z)+1}-2\right)}\right)\right]$$

$$\cancel{W(s,z,K)=}\left[\frac{\Gamma(K+\rho s+sz)}{\Gamma(K+\rho s+0.5\cdot sz)\Gamma(0.5\cdot sz+1)}\right]^{-1/(0.5\cdot sz+1)}$$

$$W(s,z,K,k)=\left[\frac{\Gamma(K+\rho s+sz)}{\Gamma(K+\rho s+0.5\cdot sz)\Gamma(0.5\cdot sz+1)}\right]^{-1/(0.5\cdot sz+1)}\left[\frac{\Gamma(K+\rho s+sz+1)}{\Gamma(K+\rho s+0.5\cdot sz)\Gamma(0.5\cdot sz+2)}\right]^{-(k-1)/(0.5\cdot sz+1)k}$$

$$\cancel{\text{wherein}}\ \omega(b)=\frac{4}{2b+3},$$

$\Gamma(x)=(x-1)!$, and

$$b(\gamma_{eff},s,z)=\frac{\alpha}{sn_{eff}}(K+\rho s+zs)$$

s represents a number of discrete-multi-tone symbols in a frame, ~~z represents a number of control code symbols per discrete multi-tone symbol, b represents a number of bit positions of a quadrature-amplitude modulation symbol,~~ ε_S represents a symbol error rate, α represents the size of a code symbol, $\omega(b)$ represents an average fraction of erroneous bits in an erroneous b-sized quadrature-amplitude-modulation symbol, γ_{eff} represents an effective signal-to-noise ratio, ~~and~~ ρ represents a ~~number of overhead symbols per discrete multi-tone symbol~~framing mode index; and n_{eff} represents an effective number of subchannels; and

selecting the value of K and the value of z which provides a maximum number of bit positions based on the one or more determined values of b ~~the maximum number of symbol errors that can be corrected t, and the number of symbols in the information field K such that the uncoded bit error rate p_b that produces a symbol error rate that is less than or equal to the target symbol error rate is increased~~.

Claim 19 (original): The method of claim 18 wherein the effective signal-to-noise ratio γ_{eff} is an average signal-to-noise ratio of at least a subset of the channels.

Claim 20 (currently amended): The method of claim 18 wherein the size of the frame ranges from 0 to N_{max}-ρs-sz symbols, where N_{max} is a predetermined value.

Claim 21 (currently amended): The method of claim 18 further comprising:

determining a difference $\Theta(K)$ between a bit error rate prior to decoding and a~~the~~ target bit error rate (p_e) based on one or more values of a length of an information field K within a range from 0 to N_{max}-ρs-sz, where N_{max} is a predetermined value, in accordance with the following relationship:

$$\cancel{\Theta(K) = \omega(b(\gamma_{eff}, s, z))p_{QAM} - p_e,\ \text{and}}$$

$$\omega(b(\gamma_{eff}, s, z))p_{QAM} = \frac{\omega\left(\frac{\alpha}{sn_{eff}}(K+\rho s+zs)\right)\left(1-2^{-\frac{\alpha}{2sn_{eff}}(K+\rho s+zs)}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}\Big/\left(2^{\frac{\alpha}{sn_{eff}}(K+\rho s+zs)+1}-2\right)}\right)}{\times\left[2-\left(1-2^{-\frac{\alpha}{2sn_{eff}}(K+\rho s+zs)}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}\Big/\left(2^{\frac{\alpha}{sn_{eff}}(K+\rho s+zs)+1}-2\right)}\right)\right]}$$

$$\Theta(K)=\omega\left(\frac{\alpha}{sn_{eff}}(K+\rho s+zs)\right)\left(1-2^{-\frac{\alpha}{2sn_{eff}}(K+\rho s+zs)}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}\Big/\left(2^{\frac{\alpha}{sn_{eff}}(K+\rho s+zs)+1}-2\right)}\right)$$
$$\times\left[2-\left(1-2^{-\frac{\alpha}{2sn_{eff}}(K+\rho s+zs)}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}\Big/\left(2^{\frac{\alpha}{sn_{eff}}(K+\rho s+zs)+1}-2\right)}\right)\right]$$
$$-\left[1-\left(1-W(s,z,K,k)\varepsilon_S^{\frac{1}{k(0.5\cdot sz+1)}}\right)^{1/\alpha}\right]$$

wherein p_{QAM} represents a probability of error in transmitting a quadrature-amplitude-modulation waveform representing a 2^b point constellation,~~ and p_e represents a channel symbol error rate~~; and

comparing the value of $\Theta(0)$ and $\Theta(N_{max}-\rho s-sz)$ to 0; and

setting the value of K ~~to a predetermined value~~ in response to the comparing.

Claim 22 (currently amended): The method of claim 21 ~~18~~wherein when $\Theta(0)<0$ and $\Theta(N_{max}-\rho s-sz)<0$, setting $K=N_{max}-\rho s-sz$.

Claim 23 (currently amended): The method of claim 18~~22~~ further comprising:

setting $b(\gamma_{eff}, s, z)$ equal to $(\alpha N_{max})/(s\ n_{eff})$ for all values of γ_{eff} and z.

$$\frac{\alpha\ N_{max}}{s\ n_{eff}}.$$

Claim 24 (original): The method of claim 18 wherein when $\Theta(0)>0$ and $\Theta(N_{max}-\rho s-sz)>0$, setting $K=N_{max}-\rho$.

Claim 25 (currently amended): The method of claim 24 further comprising:

setting s=1 and z=0~~$b(\gamma_{eff}, s, z)$ equal to $b(\gamma_{eff}, 1, 0)$~~.

Claim 26 (currently amended): An apparatus for determining an optimum bit load per subchannel in a multicarrier system with forward error correction, comprising:

means for computing a number of bit positions b of a quadrature-amplitude-modulation symbol based on one or more values of ~~one or more values of a maximum number of symbol errors that can be corrected t, and~~ a number of symbols in the information field K and one or more values of a number of control code symbols per discrete-multi-tone symbol z, to provide one or more determined values of b, ~~to determine the optimum bit load per subchannel~~ in accordance with the following relationship:

$$1-\left(1-W(s,z,K)\varepsilon_S^{\frac{1}{0.5\cdot sz+1}}\right)^{1/\alpha}$$
$$=\omega\left(b\left(\gamma_{eff},s,z\right)\right)\left(1-2^{-b\left(\gamma_{eff},s,z\right)/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}/\left(2^{b\left(\gamma_{eff},s,z\right)+1}-2\right)}\right)\text{, and}$$
$$\times\left[2-\left(1-2^{-b\left(\gamma_{eff},s,z\right)/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}/\left(2^{b\left(\gamma_{eff},s,z\right)+1}-2\right)}\right)\right]$$

$$\cancel{W(s,z,K)=}\left[\frac{\Gamma(K+s+sz)}{\Gamma(K+s+0.5\cdot sz)\Gamma(0.5\cdot sz+1)}\right]^{-1/(0.5\cdot sz+1)}$$

$$W(s,z,K)=\left[\frac{\Gamma(K+\rho s+sz)}{\Gamma(K+\rho s+0.5\cdot sz)\Gamma(0.5\cdot sz+1)}\right]^{-1/(0.5\cdot sz+1)}$$

$$\cancel{\text{wherein}}\ \omega(b)=\frac{4}{2b+3},\ \alpha\nu\delta$$

$$\Gamma(x)=(x-1)!,$$

s represents a number of discrete-multi-tone symbols in a frame, ε_S represents a symbol error rate, α represents the size of a code symbol, ρ represents a framing mode index,, ~~z~~

~~represents a number of control code symbols per discrete multi-tone symbol, b represents a number of bit positions of a quadrature-amplitude-modulation symbol,~~ $\omega(b)$ represents an average fraction of erroneous bits in an erroneous b-sized quadrature-amplitude-modulation symbol, γ_{eff} represents an effective signal-to-noise ratio, and n_{eff} represents an effective number of subchannels; and

means for selecting the value of K and the value of z which provides a maximum number of bit positions based on the one or more determined values of b ~~the maximum number of symbol errors that can be corrected t, and the number of symbols in the information field K such that the uncoded bit error rate p_b that produces a symbol error rate that is less than or equal to the target symbol error rate is increased~~.

Claim 27 (original): The apparatus of claim 26 wherein the effective signal-to-noise ratio γ_{eff} is an average signal-to-noise ratio of at least a subset of the channels.

Claim 28 (currently amended): The apparatus of claim 26~~22~~ wherein the size of the frame ranges from 0 to N_{max}-s-zs symbols, where N_{max} is a predetermined value.

Claim 29 (currently amended): The apparatus of claim 26 further comprising:

means for determining a difference $\Theta(K)$ between a bit error rate prior to decoding and a~~the~~ target bit error rate (p_e) based on one or more values of a length of an information field K within a range from 0 to N_{max}-ps-sz, where N_{max} is a predetermined value, in accordance with the following relationship:

$$\Theta(K) = \omega\big(b(\gamma_{eff}, s, z)\big)p_{QAM} - p_e, \text{ and}$$

$$\omega\left(b\left(\gamma_{eff}, s, z\right)\right)p_{QAM} = \omega\left(\frac{\alpha}{sn_{eff}}(K+s+zs)\right)\left(1-2^{-\frac{\alpha}{2sn_{eff}}(K+s+zs)}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10} / \left(2^{\frac{\alpha}{sn_{eff}}(K+s+zs)+1}-2\right)}\right) \times\left[2-\left(1-2^{-\frac{\alpha}{2sn_{eff}}(K+s+zs)}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10} / \left(2^{\frac{\alpha}{sn_{eff}}(K+s+zs)+1}-2\right)}\right)\right]$$

$$\omega\left(b\left(\gamma_{eff}, s, z\right)\right)p_{QAM} = \omega\left(\frac{\alpha}{sn_{eff}}(K+\rho s+zs)\right)\left(1-2^{-\frac{\alpha}{2sn_{eff}}(K+\rho s+zs)}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10} / \left(2^{\frac{\alpha}{sn_{eff}}(K+\rho s+zs)+1}-2\right)}\right) \times\left[2-\left(1-2^{-\frac{\alpha}{2sn_{eff}}(K+\rho s+zs)}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10} / \left(2^{\frac{\alpha}{sn_{eff}}(K+\rho s+zs)+1}-2\right)}\right)\right]$$

$$p_e = \left[1-\left(1-W(s,z,K)\varepsilon_S^{\frac{1}{0.5\cdot sz+1}}\right)^{1/\alpha}\right]$$

wherein p_{QAM} represents a probability of error in transmitting a quadrature-amplitude-modulation waveform representing a 2^b point constellation~~, and p_e represents a channel symbol error rate~~; and

means for comparing the value of $\Theta(0)$ and $\Theta(N_{max}-s-zs)$ to 0; and

means for setting the value of K ~~to a predetermined value~~ in response to the means for comparing.

Claim 30 (currently amended): The apparatus of claim 29~~26~~ wherein when $\Theta(0)<0$ and $\Theta(N_{max}-s-sz)<0$, said means for setting sets $K=N_{max}-s-zs$.

Claim 31 (currently amended): The apparatus of claim 30 further comprising:

means for setting $b(\gamma_{eff}, s, z)$equal to $(\alpha N_{max})/(s\ n_{eff})$ for all values of γ_{eff} and z.

$$\frac{\alpha\ N_{\max}}{s\ n_{eff}}\cancel{.}$$

Claim 32 (currently amended): The apparatus of claim 30 wherein when $\Theta(0)>0$ and $\Theta(N_{max}\text{-}s\text{-}sz)>0$, said means for setting sets $K=N_{max}\text{-}1$.

Claim 33 (currently amended): The apparatus of claim 32 ~~further comprising~~ wherein said means for setting sets s=1 and z=0 ~~$b(\gamma_{eff}, s, z)$equal to $b(\gamma_{eff}, 1, 0)$~~.

Claim 34 (currently amended): An apparatus for selecting forward error correction parameters in a channel having a plurality of subchannels in a multicarrier communications system, comprising:

means for determining a signal-to-noise ratio representing a subset of the subchannels to provide ~~said~~ a representative performance measurement;

means for storing, in a table, the number (s) of discrete multi-tone symbols in a forward-error-correction frame, the number (z) of forward-error-correction control symbols in the discrete multi-tone symbol associated with the signal-to-noise ratio, and the number of subchannels associated with the signal-to-noise ratio, and a net coding gain for different values of s, z, signal-to-noise ratios and numbers of subchannels; and

means for selecting forward error correction parameters of the channel based on the net coding gain by applying an approximation to a subset of values in the table.

Claim 35 (original): The apparatus of claim 34 wherein the approximation is a bilinear approximation.

Claim 36 (currently amended): An apparatus for selecting forward error correction parameters in a channel having a plurality of subchannels in a multicarrier communications system, comprising:

means for determining a signal-to-noise ratio representing a subset of the subchannels to provide ~~said~~ a representative performance measurement;

means for storing, in a table, the number (s) of discrete multi-tone symbols in a forward-error-correction frame, the number (z) of forward-error-correction control symbols in the discrete multi-tone symbol associated with the signal-to-noise ratio, the maximum number of transmissions (k) and the number of subchannels associated with the signal-to-noise ratio, and a net coding gain for different values of s, z, signal-to-noise ratios and numbers of subchannels; and

means for selecting forward error correction parameters of the channel based on the net coding gain by applying an approximation to a subset of values in the table.

Claim 37 (original): The apparatus of claim 36 wherein the approximation is a bilinear approximation.

Claim 38 (original): The apparatus of claim 36 wherein the values of s and z are in accordance with the G.dmt standard.

Claim 39 (original): The apparatus of claim 38 wherein the values of s and z are in accordance with the G.lite standard, such that a subset of the tables associated with the values of s and z in accordance with the G.dmt standard are used when the channel uses the G.lite standard.

Claim 40 (original): An apparatus for increasing a bit load of a multicarrier system comprising a channel having a plurality of subchannels, comprising:

means for determining a bit load for at least one subchannel based on a target symbol error rate ε_s, a maximum number of symbol errors that can be corrected t, a number of

symbols in an information field K, and a maximum number of transmissions k, and a number of bits per subchannel; and

means for selecting the maximum number of symbol errors t, the number of symbols in the information field K and the maximum number of transmissions k, such that a net coding gain is increased wherein the means for also selects t, K and k such that no forward error correction is applied when the number of subchannels exceeds a predetermined threshold number of subchannels.

Claim 41 (currently amended): An apparatus for determining an optimum bit load per subchannel in a multicarrier system with forward error correction, comprising:

means for computing one or more values of a <u>number of bit positions *b* of a quadrature-amplitude-modulation symbol based on one or more values of a number of symbols in an information field *K*, one or more values of a number of control code symbols per discrete-multi-tone symbol *z*, and a maximum number of transmissions *k*, to provide one or more determined values of *b*,</u> ~~maximum number of symbol errors that can be corrected t, and a number of symbols in the information field K to determine the optimum bit load per subchannel~~ in accordance with the following relationship:

$$1-\left(1-W(s,z,K)\varepsilon_S^{\frac{1}{0.5\cdot sz+1}}\right)^{1/\alpha}$$

$$\cancel{=\omega\left(b\left(\gamma_{eff},s,z\right)\right)\left(1-2^{-b\left(\gamma_{eff},s,z\right)/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}/\left(2^{b\left(\gamma_{eff},s,z\right)+1}-2\right)}\right)}\cancel{\text{, and}}$$

$$\times\left[2-\left(1-2^{-b\left(\gamma_{eff},s,z\right)/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}/\left(2^{b\left(\gamma_{eff},s,z\right)+1}-2\right)}\right)\right]$$

$$\cancel{W(s,z,K)=}\left[\frac{\Gamma(K+\rho s+sz)}{\Gamma(K+\rho s+0.5\cdot sz)\Gamma(0.5\cdot sz+1)}\right]^{-1/(0.5\cdot sz+1)}$$

$$1-\left(1-W(s,z,K,k)\varepsilon_S^{\frac{1}{k(0.5sz+1)}}\right)^{1/\alpha}$$
$$=\omega(b(\gamma_{eff},s,z))\left(1-2^{-b(\gamma_{eff},s,z)/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}/\left(2^{b(\gamma_{eff},s,z)+1}-2\right)}\right)$$
$$\times\left[2-\left(1-2^{-b(\gamma_{eff},s,z)/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10}/\left(2^{b(\gamma_{eff},s,z)+1}-2\right)}\right)\right]$$

$$W(s,z,K,k)=\left[\frac{\Gamma(K+\rho s+sz)}{\Gamma(K+\rho s+0.5\cdot sz)\Gamma(0.5\cdot sz+1)}\right]^{-1/(0.5\cdot sz+1)}\left[\frac{\Gamma(K+\rho s+sz+1)}{\Gamma(K+\rho s+0.5\cdot sz)\Gamma(0.5\cdot sz+2)}\right]^{-(k-1)/(0.5\cdot sz+1)k}$$

$$b(\gamma_{eff},s,z)=\frac{\alpha}{sn_{eff}}(K+\rho s+zs)$$

~~wherein~~ $\omega(b)=\dfrac{4}{2b+3}$, and

$\Gamma(x)=(x-1)!$,

s represents a number of discrete-multi-tone symbols in a frame, ~~z represents a number of control code symbols per discrete multi-tone symbol, b represents a number of bit positions of a quadrature amplitude modulation symbol,~~ ε_S represents a symbol error rate, α represents the size of a code symbol, $\omega(b)$ represents an average fraction of erroneous bits in an erroneous b-sized quadrature-amplitude-modulation symbol, γ_{eff} represents an effective signal-to-noise ratio, and ρ represents ~~a number of overhead symbols per discrete multi-tone symbol~~ framing mode index; and n_{eff} represents an effective number of subchannels; and

means for selecting the value of K and z to provide a maximum number of bit positions based on the one or more determined values of b ~~the maximum number of symbol errors that can be corrected t, and the number of symbols in the information field~~

~~K such that the uncoded bit error rate p_b that produces a symbol error rate that is less than or equal to the target symbol error rate is increased~~.

Claim 42 (original): The apparatus of claim 41 wherein the effective signal-to-noise ratio γ_{eff} is an average signal-to-noise ratio of at least a subset of the channels.

Claim 43 (currently amended): The apparatus of claim 41 wherein the size of the frame ranges from 0 to N_{max}-ρs-sz symbols, where N_{max} is a predetermined value.

Claim 44 (currently amended): The apparatus of claim 41 further comprising:

means for determining a difference $\Theta(K)$ between a bit error rate prior to decoding and a~~the~~ target bit error rate (p_e) in accordance with the following relationship:

$$\cancel{\Theta(K) = \omega\left(b\left(\gamma_{eff}, s, z\right)\right)p_{QAM} - p_e},$$

$$\begin{aligned}
&\omega\left(b\left(\gamma_{eff}, s, z\right)\right)p_{QAM} \\
&= \omega\left(\frac{\alpha}{sn_{eff}}(K+\rho s+zs)\right)\left(1-2^{-\frac{\alpha}{2sn_{eff}}(K+\rho s+zs)}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10} \Big/ \left(2^{\frac{\alpha}{sn_{eff}}(K+\rho s+zs)+1}-2\right)}\right) \\
&\quad\times\left[2-\left(1-2^{-\frac{\alpha}{2sn_{eff}}(K+\rho s+zs)}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10} \Big/ \left(2^{\frac{\alpha}{sn_{eff}}(K+\rho s+zs)+1}-2\right)}\right)\right]
\end{aligned}$$

$$\begin{aligned}
\Theta(K) &= \omega\left(\frac{\alpha}{sn_{eff}}(K+\rho s+zs)\right)\left(1-2^{-\frac{\alpha}{2sn_{eff}}(K+\rho s+zs)}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10} \Big/ \left(2^{\frac{\alpha}{sn_{eff}}(K+\rho s+zs)+1}-2\right)}\right) \\
&\quad\times\left[2-\left(1-2^{-\frac{\alpha}{2sn_{eff}}(K+\rho s+zs)}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_{eff}/10} \Big/ \left(2^{\frac{\alpha}{sn_{eff}}(K+\rho s+zs)+1}-2\right)}\right)\right] \\
&\quad-\left[1-\left(1-W(s,z,K,k)\varepsilon_S^{\frac{1}{k(0.5\cdot sz+1)}}\right)^{1/\alpha}\right]
\end{aligned}$$

wherein p_{QAM} represents a probability of error in transmitting a quadrature-amplitude-modulation waveform representing a 2^b point constellation~~, and p_e represents a channel symbol error rate~~;

comparing the value of $\Theta(0)$ and $\Theta(N_{max}-\rho s-zs)$ to 0; and

setting the value of K ~~to a predetermined value~~ in response to the comparing.

Claim 45 (currently amended): The apparatus of claim 44[[41]] wherein when $\Theta(0)<0$ and $\Theta(N_{max}-\rho s-sz)<0$, said means for setting sets $K=N_{max}-\rho s-zs$.

Claim 46 (currently amended): The apparatus of claim 45 further comprising:

means for setting $b(\gamma_{eff}, s, z)$ equal to $(\alpha\ N_{max})/(s\ n_{eff})$ for all values of γ_{eff} and z.

$$\frac{\alpha\ N_{max}}{s\ n_{eff}}$$

Claim 47 (currently amended): The apparatus of claim 41 wherein when $\Theta(0)>0$ and $\Theta(N_{max}-\rho s-sz)>0$, said means for setting sets $K=N_{max}-\rho$.

Claim 48 (currently amended): The apparatus of claim 47 ~~further comprising~~ wherein said means for setting sets s=1 and z=0 ~~$b(\gamma_{eff}, s, z)$ equal to $b(\gamma_{eff}, 1, 0)$~~.

Claim 49 (new): A method of selecting forward error correction parameters in a channel having a plurality of subchannels in a multicarrier communications system, comprising:

storing, in one or more tables, a net coding gain for a plurality of values of signal-to-noise ratios and numbers of subchannels, the net coding gain being based on a one or the values of the signal-to-noise ratios and one of the numbers of subchannels, a number (s) of discrete multi-tone symbols in a forward-error-correction frame, a

number (z) of forward-error-correction control symbols in a discrete multi-tone symbol, a maximum number of transmissions (k), for different values of s, z and k;

determining a signal-to-noise ratio representing a subset of the subchannels to provide a representative performance measurement; and

selecting values of s, z and k based on the representative performance measurement and the net coding gain by applying an approximation to a subset of the values in the table.

Claim 50 (new): The method of claim 49 wherein the approximation is a bilinear approximation.

Claim 51 (new): The method of claim 49 wherein and the values of s and z are in accordance with the G.dmt standard.